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SEP 12 2003
TC 1700Docket No.
SMT0335/SLA0587

Serial No 09/270,606	Filing Date March 17, 1999	Examiner M. Anderson	Group Art Unit 1765
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Invention: Method for Modification of Polishing Pattern Dependence in Chemical Mechanical Polishing

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, including a set of formal drawings and a copy of the request for a two month extension of time, with respect to the Notice of Appeal filed on May 5, 2003.

The fee for this Appeal Brief is \$320.00.

- ☒ Please charge Deposit Account No. 19-1457 in the amount of \$320.00.
A duplicate copy of this sheet is enclosed.
- ☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 19-1457.
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- ☒ Any additional fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 C.F.R. 1.17.
- ☒ Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time. In the event that a petition and fee are required, please consider this a petition and charge any necessary fee to the Deposit Account No. 19-1457.

Signature

Dated: September 5, 2003

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I certify that this document and fee is being deposited on September 5, 2003 with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313.

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SEP 12 2003

TC 1700

PATENT APPLICATION
Attorney Docket No. SLA0587 (SMT 335)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

PATENT APPLICATION

Inventor: David Russell Evans

Serial No: 09/270,606

Group No.: 1765

Filed: March 17, 1999

Examiner: M. Anderson

Title: METHOD FOR MODIFICATION OF
POLISHING PATTERN
DEPENDENCE IN CHEMICAL
MECHANICAL POLISHING

APPEAL BRIEF
(37 C.F.R. §1.192)

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ATTENTION: Board of Patent Appeals and Interferences

Applicants respectfully submit this appeal brief in support of the appeal to the rejection of the claims in the above-identified application. The Notice of Appeal was filed in this case on May 5, 2003.

REAL PARTY IN INTEREST

Upon the filing of the patent application, as referenced above, all interest in the present invention had been assigned by the above-named inventors to Sharp Laboratories of America, Inc., of Camas, WA., a subsidiary of Sharp Electronics Corporation of Mahwah, NJ, which is a subsidiary of Sharp Corporation of Osaka, Japan.

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09/270,606
SLA0587 (SMT 335)

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences related to the above-mentioned patent application.

STATUS OF CLAIMS

The patent application was filed with claims 1-9.

Claims 10-20 were added during prosecution.

No claims have been cancelled.

Claims 1-20 are pending.

No claims have been allowed.

Claims 1-20 stand rejected.

Claims 1-20 are currently on appeal.

STATUS OF AMENDMENTS

No amendments have been filed subsequent to final rejection. Appellant has submitted formal drawings along with this appeal.

SUMMARY OF INVENTION

A method of fabricating an integrated circuit using chemical mechanical polishing (CMP) is provided. Fig. 1 shows what is essentially the ideal polishing behavior that is sought in the CMP art. Fig. 2 and Figs 3a through 3d show the more common case in the prior art using a strong alkali solution with fused silica, for cases where no dummy structures or stop layers are present. Note that the high area polishing rate 24 is higher than the blanket polishing rate 20. Fig. 4 shows a ceria based slurry which has a high area polishing rate 42 that is lower than the blanket polishing rate 20, and the low area polishing rate is essentially zero. The present method is best understood with reference to Figs. 7a, 7b and 8. In Fig. 7a the high area polishing rate noted as 82 (including 82a, 82b, 82c, and 82d, which correspond to different feature size scales) approximates the blanket polishing rate 20. This is was accomplished by introducing 10%

ethylene glycol to a ceria slurry such that the typically lower polishing rate is increased for the high areas until it corresponds to the blanket rate, while simultaneously maintaining the low area polishing rate 84 at essentially zero. Fig. 7b shows the effect of introducing additional ethylene glycol, which has the effect of making the ceria slurry behave more like the fused silica slurry shown in Fig. 2. Fig. 8 illustrates that increasing the down force will bring the polishing characteristics for the slurry shown in Fig. 7b, back to substantially match that of Fig. 7a, which had less ethylene glycol. (See page 5, line 15, through page 7 line 9).

The present method provides a means to utilize a ceria slurry having a polishing rate for high structures that is lower than the blanket polishing rate, and incorporating a slurry modifier to increase the high structure polishing rate until it approximates the blanket polishing rate. While the high area polishing rate has been increased, the low area polishing rate is preferably maintained at essentially zero.

ISSUES

Issue 1 – Whether claims 1-3, 5-6, and 10-11 are patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Issue 2 – Whether claims 4, 7-9, 12 and 16 are patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Issue 3 – Whether claims 13-14 are patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Issue 4 – Whether claim 15 is patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Issue 5 – Whether claims 17-19 are patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Issue 6 – Whether claim 20 is patentable under 35 U.S.C. §103(a) over Koderia *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

GROUPING OF CLAIMS

Claims 1-3, 5-6, and 10-11 stand or fall together.

Claims 4, 7-9, 12 and 16 stand or fall together

Claims 13-14 stand or fall together.

Claim 15 stands alone.

Claims 17-19 stand or fall together.

Claim 20 stands alone.

ARGUMENTS

Prior to discussing each rejection under 35 U.S.C. § 103, appellant would like to address certain issues, which may be discussed further below.

With regard to the Examiner's note in the Response to Arguments, appellant is well aware that one cannot show nonobviousness by attacking references individually where rejections are based upon combinations of references. *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). However, just as the Examiner presented each reference in turn to argue for the combination, appellant will address each cited reference in turn so that the weakness of each reference may be made clear, so that the inapplicability of the combination may be put forth.

Appellant notes that the Koder reference (U.S. 5,445,996) contains multiple separate and distinct embodiments, along with a lengthy discussion of the prior art. These embodiments include, but are not limited to the following examples: **i}** the use of ceria based slurry to provide a CMP process that is free of scars (See Column 19, line 49 through Column 20 line 49, referring to Figs. 9A -9F); **ii}** the use of an overlying stopper film, which has a lower polishing rate, to reduce or eliminate the "dishing" phenomenon (See Column 24, line 17 through Column 26, line 12, referring to Figs. 21-27); **iii}** a polishing apparatus (See Column 36, line 64 through Column 37, line 63, referring to Figs. 40-43; and **iv}** a method for redressing the polishing cloth to maintain the polishing rate of the polishing cloth over time (See Column 42, line 56 through Column 44, line 26, referring to Figs. 49 - 51). These multiple and varied embodiments provide a virtual toolkit of elements that, if not considered carefully, may provide a means for engaging in

inappropriate hindsight analysis. Appellant further contends that where a problem or limitation is not explicitly discussed, possibly as the problem is not relevant to the specific embodiment, it is inappropriate to assume that the problem has been eliminated in that embodiment. This is particularly the case with regard to any supposed absence of discussion of the “dishing” problem in connection with those embodiments that do not explicitly discuss it.

The Examiner has indicated on the Office Action Summary that the drawings originally submitted on March 17, 1999 are objected to. No further comments were made regarding this objection. Appellant includes a set of formal drawings with this Appeal in the hope of overcoming these unspecified objections.

REJECTIONS UNDER 35 U.S.C. §103

Claims 1-20 have been rejected under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996) in view of Grover *et al.* (U.S. 5,759,917) and further in view of Burke *et al.* (U.S. 5,934,978).

The Examiner bears the initial burden of establishing a *prima facie* conclusion of obviousness. (See MPEP §2142). To establish a *prima facie* case of obviousness, three basic criteria must be met. There must be some teaching or suggestion to modify the reference or combine reference teachings. There must be a reasonable expectation of success. The prior art reference must teach or suggest all claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on appellants' disclosure. *In re Vaeck*, 947 F.2d 488, (Fed. Cir. 1991).

“It is impermissible to use the claimed invention as an instruction manual or “template” to piece together the teachings of the prior art so that the claimed invention is rendered obvious.” *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992). “One cannot use hindsight reconstruction to

pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.”

In re Fine, 837 F.2d 1071, 1075 (Fed. Cir. 1988).

Kodera *et al.* has been presented as teaching the use of an aqueous slurry containing cerium oxide as a preferred method of polishing with specific reference to Figs 19A through 19F. Fig. 19E shows a device with an SiO₂ layer 205, having raised portions and recessed portions. Following a CMP process using a cerium oxide slurry the device is shown planarized in Fig., 19F and is described as completely planarized with no scars in col. 20, at lines 45-50. There is no discussion in this section, related to this embodiment, regarding the dishing problem caused by the polishing of recessed regions at a non-zero rate. The Examiner has inappropriately assumed that the lack of mention of a “dishing” problem means that there was no “dishing” problem. The Examiner states,

“This implies that the high structures are preferentially polished until they are removed. This in turn implies the rate of polishing the high structure areas at a higher rate than the low areas. Otherwise planarization would not be obtained.”

(See Examiner’s Detailed Action of May 5, 2003, at section 2. paragraph 2). However, these implied statements do not imply that there is no “dishing” problem. There is also no implication that the low structure areas are polished at a substantially zero rate, or the high structure areas are polished at approximately the blanket polishing rate. These desirable characteristics appear to be assumed by the Examiner. Appellant concedes that it is counter intuitive that the low, or recessed, areas are polished even while the high, or raised, areas remain. However, Kodera *et al.* contains a detailed discussion of this phenomenon which results in the prior art problem of “dishing”. Figs. 2A-2C illustrate the problem. Fig. 4 illustrates the respective polishing rates of recessed areas and raised areas, which contributes to the “dishing” problem. Figs. 5A through 5D show one prior art proposed solution to this problem, which incorporates a stopper layer.

(See Koderer at col. 2, line 62 through col 5, lines 56.) Appellant also addresses this issue in Fig. 2 of the present application. It is to be noted that Appellant's Fig. 1 shows the idealized case that the art is attempting to achieve. Appellant is concerned that many of the difficulties in obtaining this ideal are being assumed away, especially where Koderer *et al.* is silent, typically because they are addressing other concerns with respect to those other embodiments.

Koderer *et al.* provides a discussion of a proposed solution to the "dishing" problem in connection with Figs. 21A-21E and Fig. 22-28, as discussed at col. 24, line 17 through col. 26, line 12. The solution to the "dishing" problem presented by Koderer *et al.* employs an overlying stopper film 208. As described in connection with Fig. 22, this stopper film provides an essentially zero polishing rate for the recessed portions while they are protected by the stopper film 208. Appellant has previously amended the claims to clarify that the results are achieved without the use of a dummy structure.

In response to the amendment, the Examiner has cited several portions of Koderer *et al.* that discuss polishing methods, and systems, that do not require the use of a dummy structure, or stop layer, along with other portions that refer to a surface active agent. For example, the Examiner states, "The lack of an etch stop layer or dummy structure is disclosed in col. 37, lines 44-64." Looking at the teaching of this embodiment as a whole, by reviewing Koderer *et al.* from col. 36, line 64 through col. 37, line 63, it becomes apparent that by employing distortion sensors 551 and 552 (as shown in Fig. 40 and referred to at col. 37, lines 4 through 8) the planarization stopping point can be detected, thereby eliminating the need for a hard stop to protect the wiring layer 210. There is no teaching or suggestion that the use of these distortion sensors addresses the problem of recessed areas being polished or that the polishing rate of the high structures has been modified by a slurry modifier. One of ordinary skill in the art would read each embodiment

for its teaching, and would not put disparate elements together, in the absence of hindsight analysis relying of appellant's teaching.

Similarly, the suggestion to use a surface active agent as indicated by reference to col. 44, lines 3-11, and particularly line 10, are similarly being extracted out of context. By reviewing the whole of col. 42, line 56 through col. 44, line 11 it will become apparent that this embodiment is concerned with redressing the polishing plane by feeding the polycarboxylic acid type negative ion surface agent onto the polishing cloth 504, and then rubbing the polishing cloth with a brush, and then washing the polishing cloth with pure water (See col. 43 lines 11-23). The Fig. 51, which is referred to as supporting a constant polishing rate, relates to the polishing cloth when the redress process is employed as necessary. This teaching in no way suggests the use of a surface agent to modify the polishing characteristics of the slurry. And does not address the relative polishing rates of low and high areas, or the "dishing" problem. This element is being artificially extracted to fit a rejection that could only have been arrived at through hindsight.

Appellant has pointed out the weaknesses associated with the primary reference, Kodera *et al.* Appellant is not trying to argue over a single reference, but rather indicate that the reference does not teach what it is being asserted to teach. These missing elements have not been cited as being provided by either Grover *et al.* or Burke *et al.* as will be discussed shortly. As the cases cited above indicate, the combination cannot support an obviousness rejection where the teaching or suggestion is not found in the prior art, or where hindsight analysis has prompted a combination of elements where there is otherwise no teaching or suggestion to combine them.

The Examiner indicates that Grover *et al.* teaches the use of a ceria slurry with a

carboxylic acid modifier, and that this slurry is used to polish excess oxide using a CMP process. Grover *et al.* teaches a range of metal abrasive between 2 and 25% and a down force of 9 psi. Grover *et al.* is concerned with providing a slurry that will polish silicon oxide preferentially to silicon nitride, as shown in Fig. 1 and stated in the abstract. The silicon nitride layer is applied to the silicon to prevent polishing of the masked silicon oxide of the device. (See col 1, lines 25-36). The silicon nitride acts as a stop layer to protect the underlying structure. The Examiner stated that, "The excess oxide is polished using CMP such that the surface is planar (i.e. the high spots are removed and the low spots are essentially untouched." Appellant is again concerned with the continued assumption that the low spots are essentially untouched. It is possible to planarize a surface without the low spots going untouched, for example by the high spots being polished faster and the low spots being polished slower. This is in no way equivalent to the low spots being essentially untouched. This distinction is described above with reference to both appellant's teaching and that of Kodera *et al.* and contributes to the "dishing" problem. This misunderstanding appears to be one of the keys underlying these rejections, and is a leap being made without any support in the prior art. While Grover *et al.* may use a ceria slurry with a carboxylic acid modifier, there is not teaching or suggestion that the modifier would contribute to the result provided by appellant's method.

Burke *et al.* is relied upon to show the addition of a suspension agent to improve the colloidal behavior of the abrasive particles and to inhibit coalescence of the particles. (See cols. 3 and 4, lines 60+ and 1-9). The suspension agent inhibits the growth and/or coalescence of the preexisting particles. The use of a suspension agent is related to lowering defects (See col. 1, lines 62-64). So while Burke *et al.* may disclose the use of a suspension agent, including ethylene glycol, there is no teaching or suggestion that a suspension agent, or dispersion agent,

will modify the polishing rate of the slurry as taught by appellant.

Having generally addressed the rejection and short comings of the three cited references, appellant will now consider the references and their combination in connection with the grouped claims.

Issue 1 – Claims 1-3, 5-6, and 10-11 are patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

For example, with regard to independent claim 1, Kodera *et al.* does not teach or suggest in combination with itself, or Grover *et al.* and/or Burke *et al.* that a slurry modifier be added to a cerium oxide slurry to modify its polishing properties such that it will polish high structure areas at a rate approximating the blanket polishing rate while polishing low areas at a substantially zero rate, **without the use of a dummy structure**. While Kodera *et al.* discloses some embodiments that do not require dummy, or stop layers, as discussed above, the only method of providing for the claimed polishing behavior is through the use of a stopper film. Although, Grover *et al.* and Burke *et al.* provide additional detail as to concentrations of metal oxide abrasives, down force and the use of suspension agents, they do not alone, or in combination, suggest a process of modifying a slurry with a slurry modifier to control the polishing characteristics in the manner claimed by appellant.

Although, some, or all, of the elements may be present, appellant contends that the Examiner has put these elements together by relying on appellant's teaching as a guide. As discussed above, especially in regards to Kodera *et al.*, a reading of each embodiment disclosed to determine what it teaches one of ordinary skill in the art would not suggest the combination relied upon to reject these claims. A proper reading of Grove *et al.* and Burke *et al.* likewise

fails to teach, or suggest, the desirability of combining these references.

Appellant respectfully requests allowance of claims 1-3, 5-6, and 10-11.

Issue 2 –Claims 4, 7-9, 12 and 16 are patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

The Examiner acknowledges that neither Kodera *et al.* nor Grover *et al.* disclose the use of ethylene glycol. While Burke *et al.* does disclose the use of ethylene glycol to inhibit coalescence of pre-existing particles to reduce scratches and defects, it does not provide the missing teaching that ethylene glycol, or any other modifier, will change the polishing characteristics in the manner required by claims 4, 7-9, 12 and 16.

Issue 3 –Claims 13-14 are patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Claims 13 and 14 form a slurry with a high structure polishing rate lower than the blanket polishing rate and then introducing a slurry modifier to produce a slurry with a high structure polishing rate approximating the blanket polishing rate. There is no limitation regarding the low structure polishing rate. Even so, there is no teaching or suggestion in the combination of Kodera *et al.*, Grover *et al.* and Burke *et al.* that it would be possible or desirable to form a slurry and then modify it to obtain the polishing rate as claimed by claims 13 and 14.

Appellant respectfully requests allowance of claims 13 and 14.

Issue 4 –Claim 15 is patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Claim 15 depends from claim 13 and provides for using ethylene glycol as the slurry modifier. Even if for the sake of argument Kodera *et al.* shows a slurry with a polishing rate approximating the blanket polishing rate, and Burke *et al.* teaches the use of ethylene glycol as a suspension agent, the three references alone, or in combination, still do not teach or suggest that ethylene glycol will modify the slurry to accomplish the process claimed in claim 15.

Appellants request allowance of claim 15.

Issue 5 –Claims 17-19 are patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Claims 17 through 19 refer to a CMP slurry having a low-density high structure polishing rate that is essentially the same as a high-density high structure polishing rate. Appellant notes that Kodera *et al.* seems to have some illustration related to this at Figs. 30A through 30C, col. 28, lines 33 – 68, and Figs. 32A through 32C, col. 29, line 49, through col. 30 line 49. However, appellants note that both of these embodiments incorporate a dummy structure, or stopper layer. In Figs. 30A through 30C this is 203 as indicated at col. 28, lines 62—68. In Figs. 32A through 32C the layer acting as a stopper layer is 233A, which is an amorphous silicon layer. Nothing has been cited by the Examiner to address this limitation in any of the three references, alone or in combination.

Appellants request allowance of claims 17 and 19.

Issue 6 –Claim 20 is patentable under 35 U.S.C. §103(a) over Kodera *et al.* (U.S. 5,445,996), in view of Grover *et al.* (U.S. 5,759,917), and further in view of Burke *et al.* (U.S. 5,934,978).

Claim 20 depends from claim 17, and is in addition allowable, since no teaching, or

suggestion, to combine Koderer *et al.*, Grover *et al.* and Burke *et al.* has been presented which would indicate that including ethylene glycol in the slurry would provide a slurry with the same polishing rate for both high-density and low-density high areas.

Appellants request allowance of claim 20

CONCLUSION

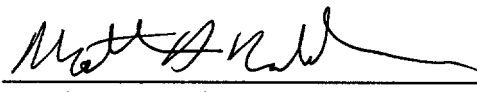
For the extensive reasons advanced above, Applicants respectfully contend that the Examiner has not met the necessary burden for a *prima facie* case of obviousness, and further that each claim is nonobvious in light of the cited prior art and otherwise patentable. No teaching or suggestion to combine the three references has been provided. Furthermore, the combination of elements extracted from Kodera *et al.* without reading the teachings as a whole tend to suggest that the rejection was at least in part the result of inappropriate hindsight analysis. Therefore, reversal of all rejections is courteously requested.

Appellant has attached a set of formal drawings, in part in response to a objection noted in the Office Action Summary. As the objections were not specific, it is hoped that this will eliminate any and all objections concerning the drawings.

Appellant has attached a copy of a request for extension of time, which was already submitted on this date, September 5, 2003

Respectfully submitted,

Date: Sept. 5, 2003


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APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

1. A method of fabricating an integrated circuit using CMP comprising:
 - providing a substrate with an overlying silicon dioxide layer ,
 - and without any dummy structure;
 - forming a CMP slurry containing cerium oxide;
 - adding a slurry modifier to the slurry, wherein the slurry modifier combined with CMP slurry polishes low structure areas at a substantially zero rate and polishes high structure areas at a rate approximating a blanket polishing rate without the use of a dummy structure; and
 - polishing the silicon dioxide layer without polishing any dummy structure using the modifier-containing slurry, whereby the low structure areas are polished at a substantially zero rate and the high structure areas are polished at a rate approximating the blanket polishing rate without using any dummy structure.
2. The method of claim 1 wherein said forming includes setting a cerium oxide concentration of between about 1% and 50% by weight.
3. The method of claim 1 wherein said polishing includes CMP at a pressure of between about five psi and ten psi.
4. The method of claim 1 wherein said adding includes adding ethylene glycol at a concentration of up to 50%.

5. A method of fabricating an integrated circuit using CMP comprising:
- providing a substrate with an overlying silicon dioxide layer ,
 - and without any dummy structure;
 - forming a CMP slurry containing cerium oxide at a concentration of between about 1% and 50% by weight;
 - adding a slurry modifier to the slurry, wherein the slurry modifier combines with the CMP slurry to enable polishing of low structure areas at a substantially zero rate and polishing of high structure areas at a rate approximating a blanket polishing rate; and
 - polishing the silicon dioxide layer without any dummy structures using the modifier-contained slurry, whereby the low structure areas are polished at a substantially zero rate and the high structure areas are polished at a rate approximating the blanket polishing rate without using a dummy structure.
6. The method of claim 5 wherein said polishing includes CMP at a pressure of between about five psi and ten psi.
7. The method of claim 5 wherein said adding includes adding ethylene glycol at a concentration of up to 50%.

8. A method of fabricating an integrated circuit using CMP comprising:
- providing a substrate with an overlying silicon dioxide layer ,
 - and without any dummy structure;
 - forming a CMP slurry containing cerium oxide at a concentration of between about 1% and 50% by weight;
 - adding ethylene glycol at a concentration of up to 50% for polishing low structure areas at a substantially zero rate and polishing high structure areas at a rate approximating a blanket polishing rate; and
 - polishing the silicon dioxide layer without any dummy structure using the slurry, whereby the low structure areas are polished at a substantially zero rate and the high structure areas are polished at a rate approximating the blanket polishing rate without using a dummy structure.
9. The method of claim 8 wherein said polishing includes CMP at a pressure of between about five psi and ten psi.

10. A method of fabricating an integrated circuit using CMP comprising:
- providing a substrate with an overlying silicon dioxide layer, and without any dummy structure such that the silicon dioxide layer forms low structure areas and high structure areas;
 - forming a CMP slurry containing cerium oxide;
 - adding a slurry modifier to the slurry to produce a modified slurry that polishes the low structure areas at a substantially zero rate and polishes the high structure areas at a rate approximating a blanket polishing rate without relying on any dummy structure; and
 - polishing the silicon dioxide having high structure areas and low structure areas using the modified slurry, whereby high structure areas are polished at a rate approximating a blanket polishing rate and low structure areas are polished at a substantially zero rate.
11. The method of claim 10, wherein the high structure areas and the low structure areas are both formed of silicon dioxide.
12. The method of claim 10, wherein the slurry modifier is ethylene glycol.

13. A method of fabricating an integrated circuit using CMP comprising:

providing a substrate with an overlying silicon dioxide layer , and without any dummy structure such that the silicon dioxide layer forms low structure areas and high structure areas, without any dummy structure;

forming a CMP slurry having a high structure polishing rate lower than a blanket polishing rate;

adding a slurry modifier to the slurry to produce a modified slurry that polishes high structures at a rate approximating the blanket polishing rate; and

polishing the high structure areas of silicon dioxide, whereby the high structure areas are polished at a rate approximating the blanket polishing rate without using any dummy structure.

14. The method of claim 13, wherein the CMP slurry comprises cerium oxide.

15. The method of claim 13, wherein the slurry modifier is ethylene glycol.

16. A method of chemically-mechanically polishing a silicon dioxide layer having high structure areas and low structure areas overlying a semiconductor substrate comprising:

forming a slurry comprising cerium oxide and ethylene glycol;
and

polishing the silicon dioxide layer, without any dummy structure, such that the high structure areas are polished at a rate approximating a blanket polishing rate, and the low structure areas are polished at a substantially zero rate, without using any dummy structure.

17. A method of fabricating an integrated circuit using CMP comprising:

providing a substrate with an overlying silicon dioxide layer, and without any dummy structure such that the silicon dioxide layer forms low structure areas and high structure areas;

forming a CMP slurry having a low-density high structure polishing rate and a high-density high structure polishing rate, wherein the low-density high structure polishing rate is essentially the same as a high-density high structure polishing rate; and

polishing the high structure areas without the use of dummy structures, whereby the polishing rate is independent of pattern density.

18 The method of claim 17, wherein said forming includes setting a cerium oxide concentration of between about 1% and 50% by weight.

19 The method of claim 17, wherein said polishing includes CMP at a pressure of between about five psi and ten psi.

20 The method of claim 17, wherein said forming includes adding ethylene glycol at a concentration of up to 50%.



Fig. 1

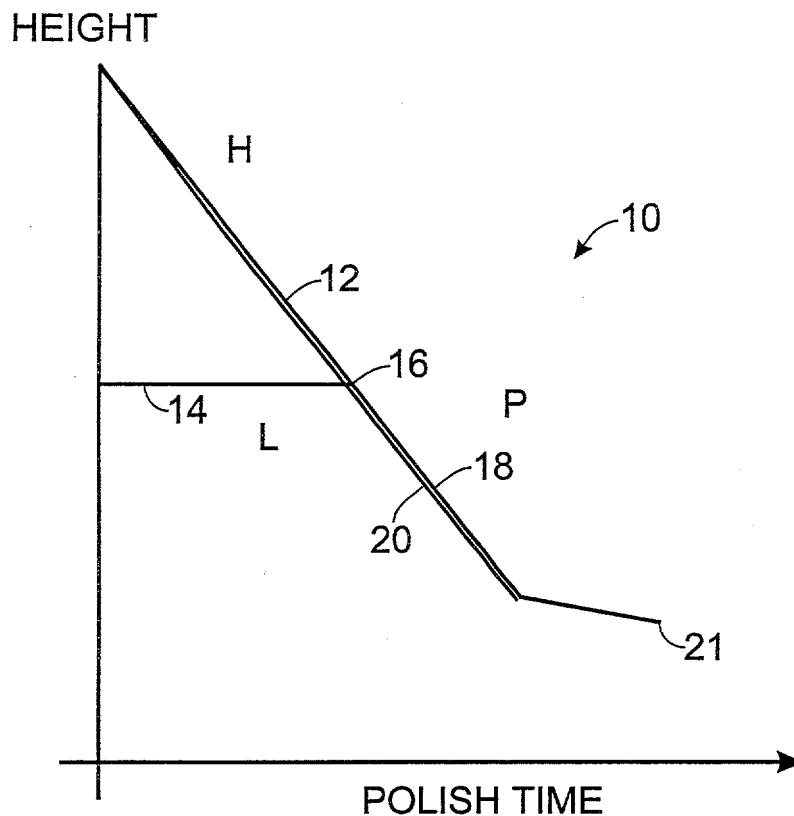


Fig. 2

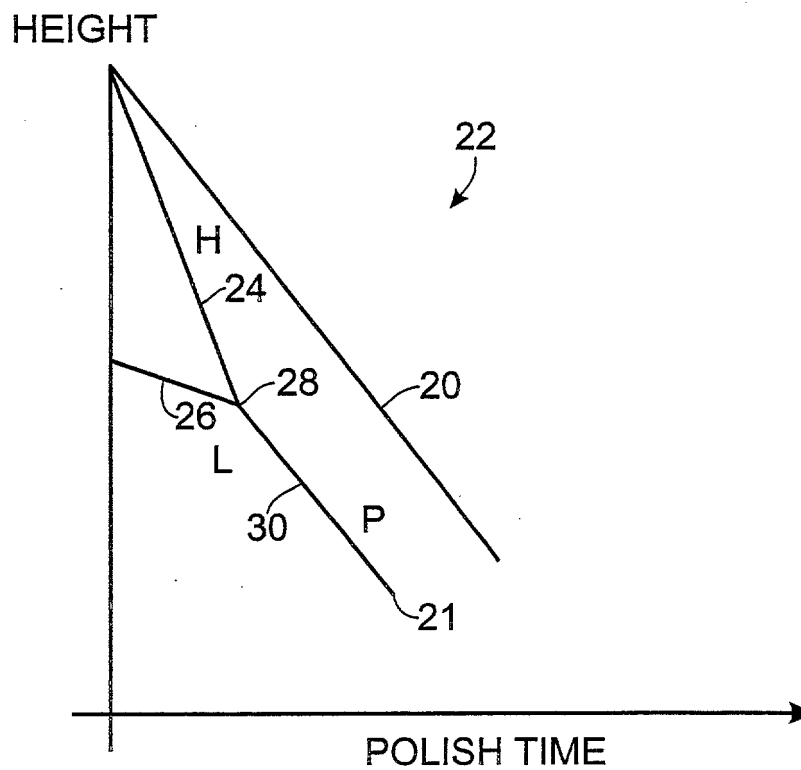




Fig. 3A

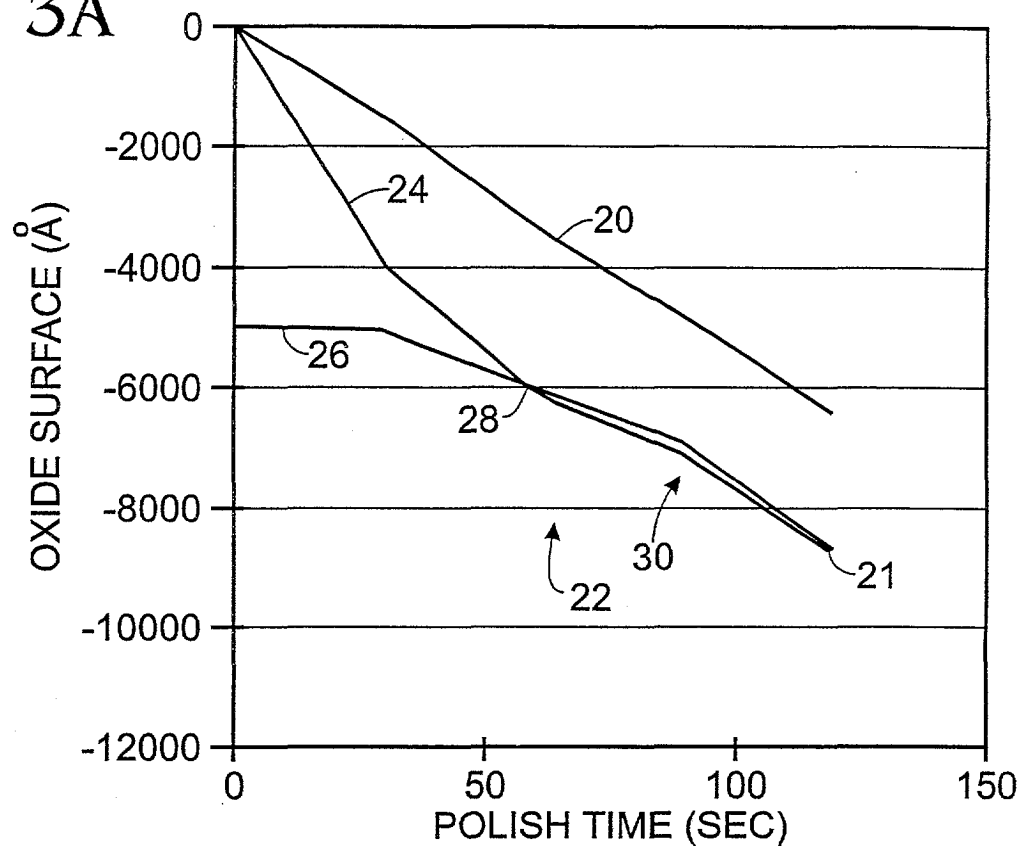


Fig. 3B

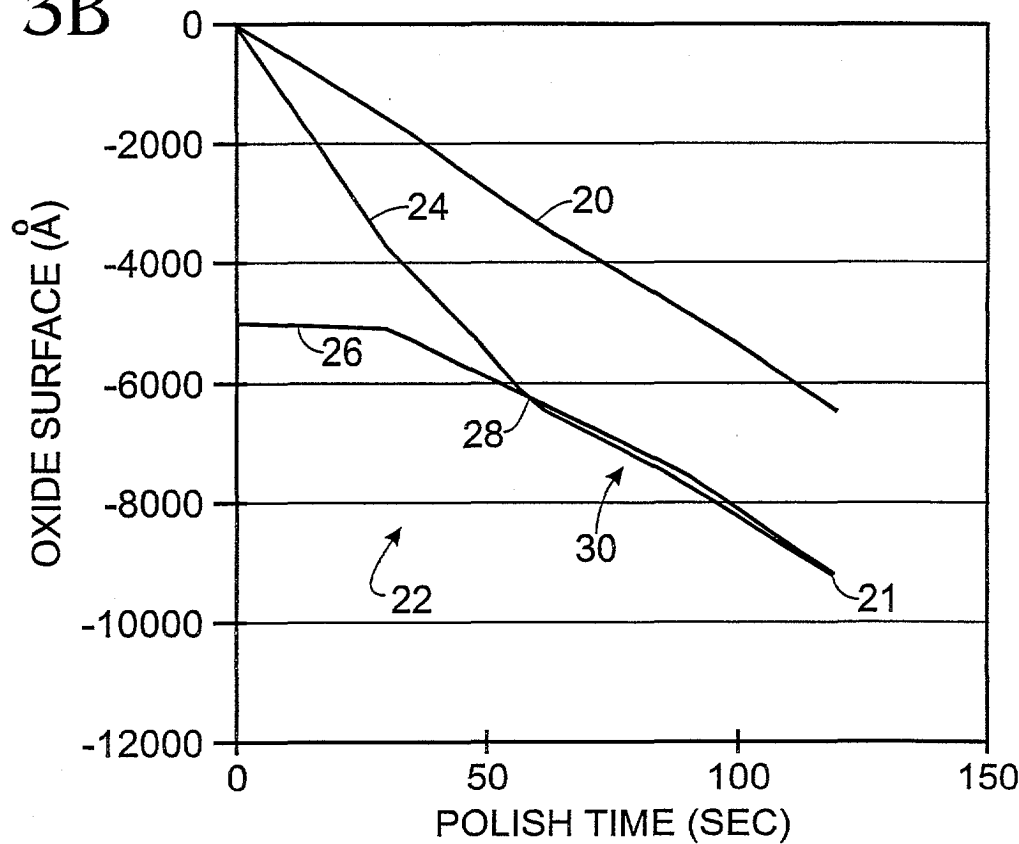




Fig. 3C

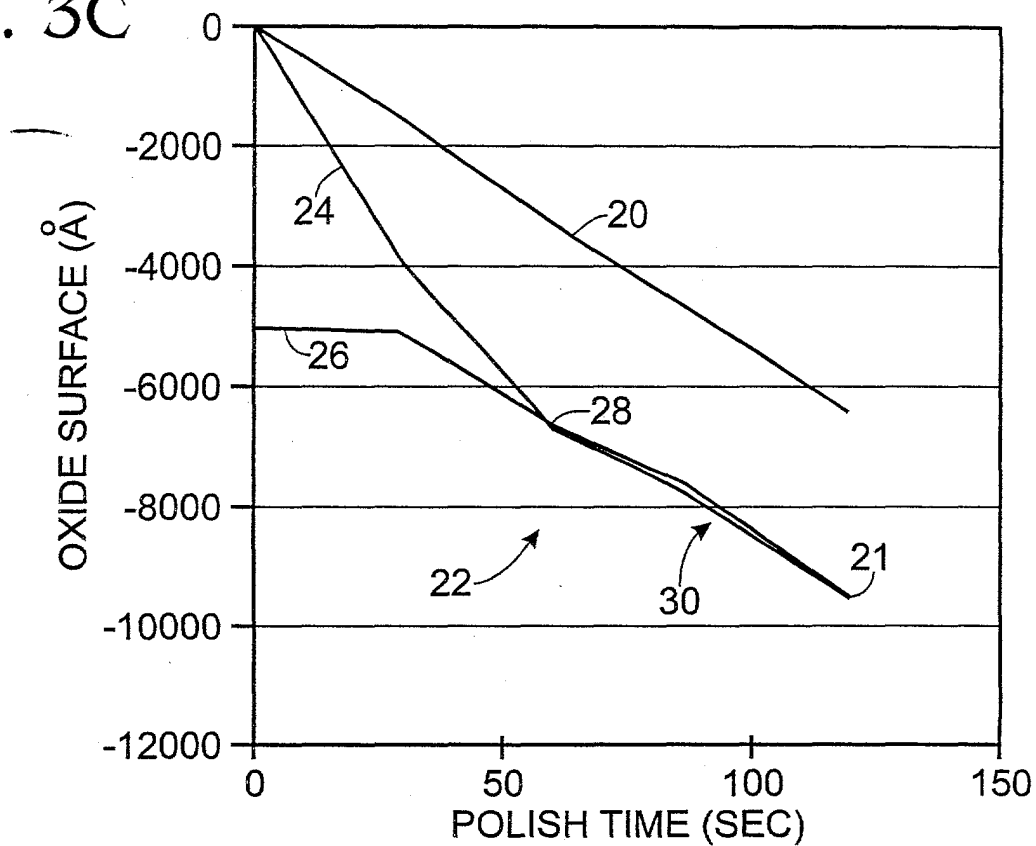


Fig. 3D

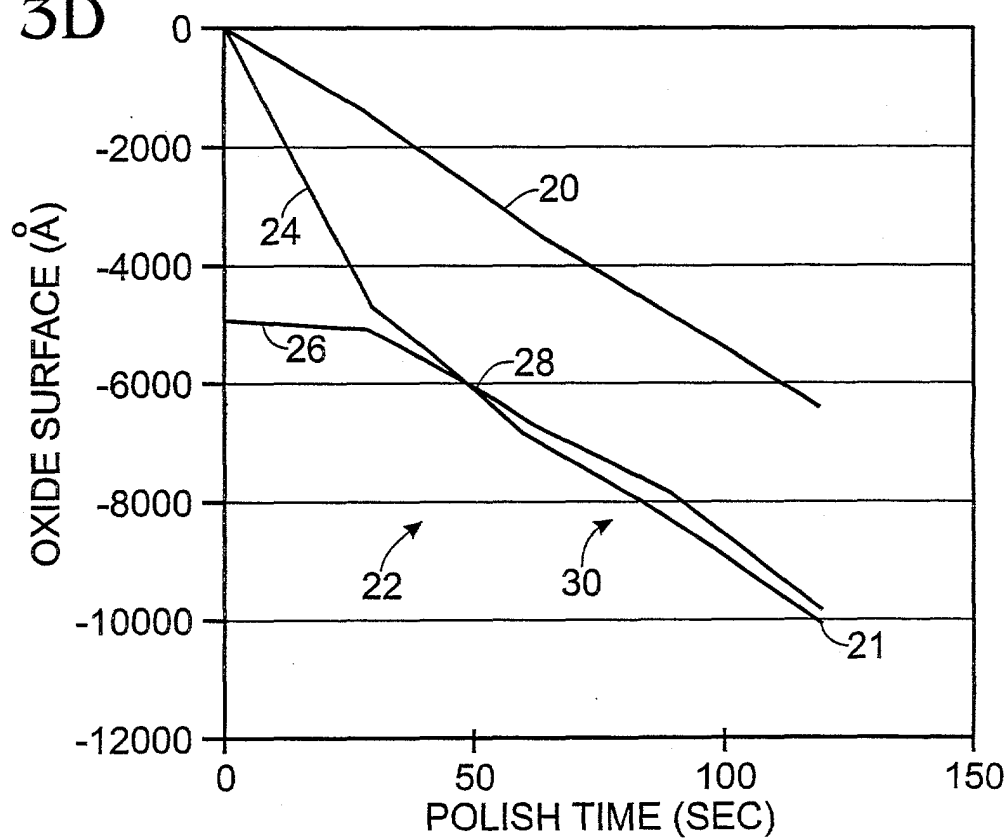




Fig. 5B

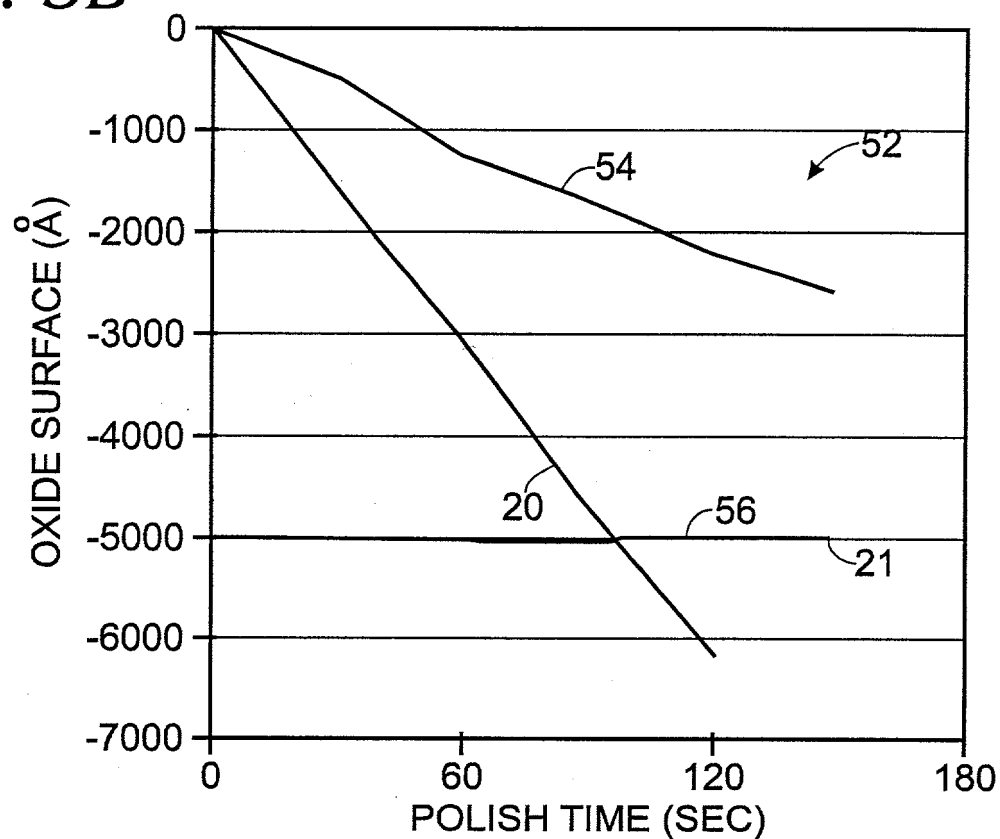


Fig. 5C

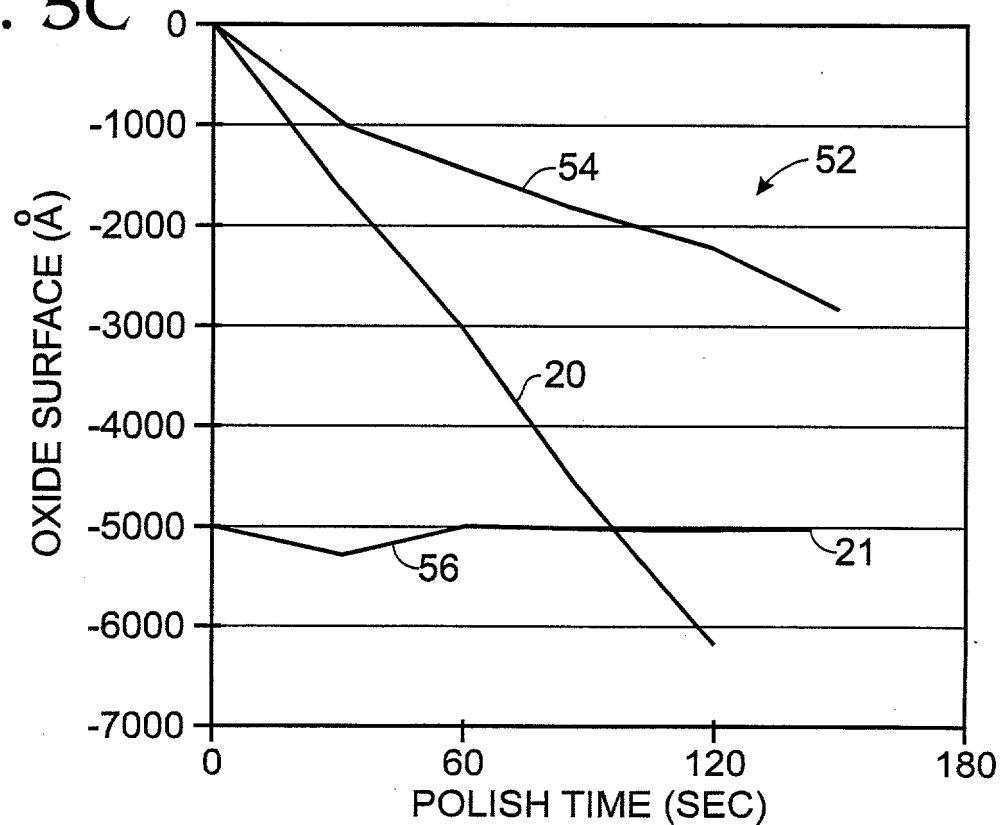




Fig. 6B

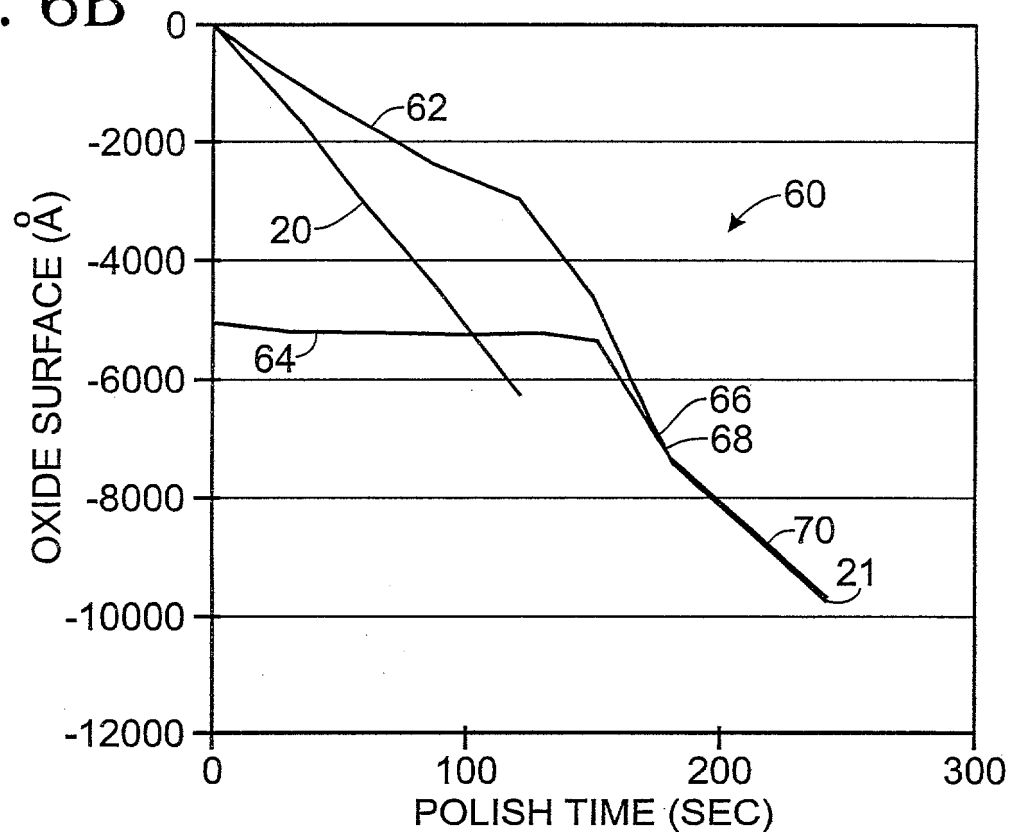


Fig. 6C

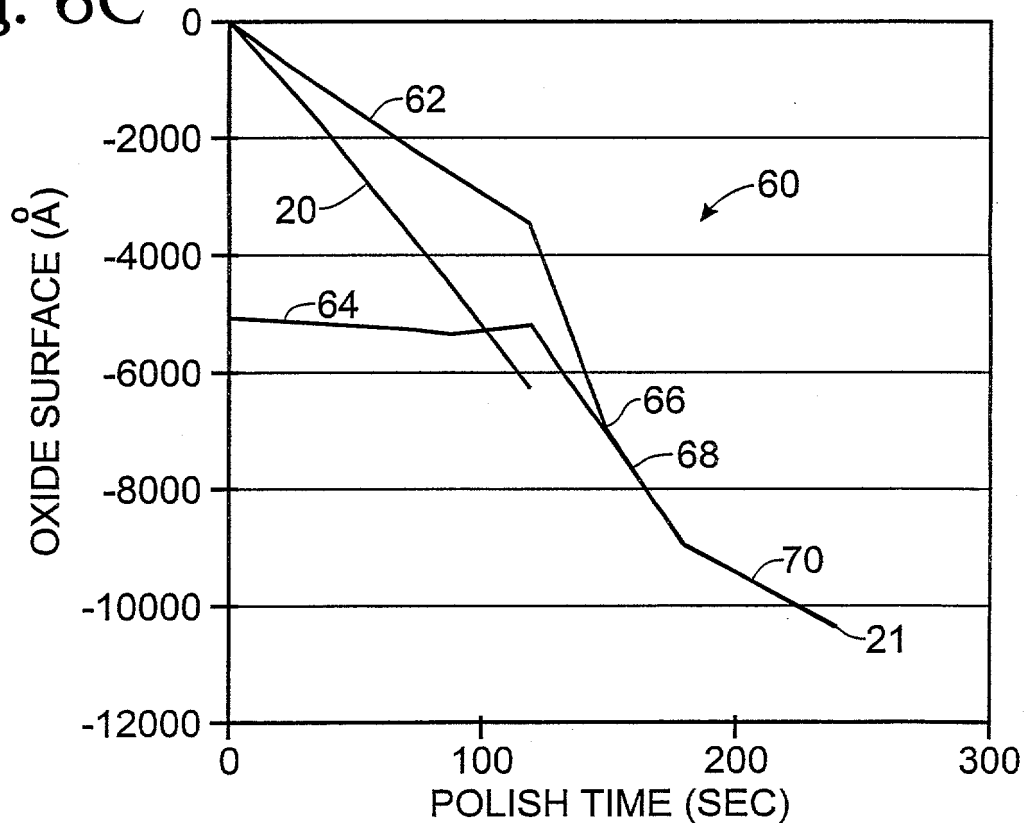




Fig. 7B

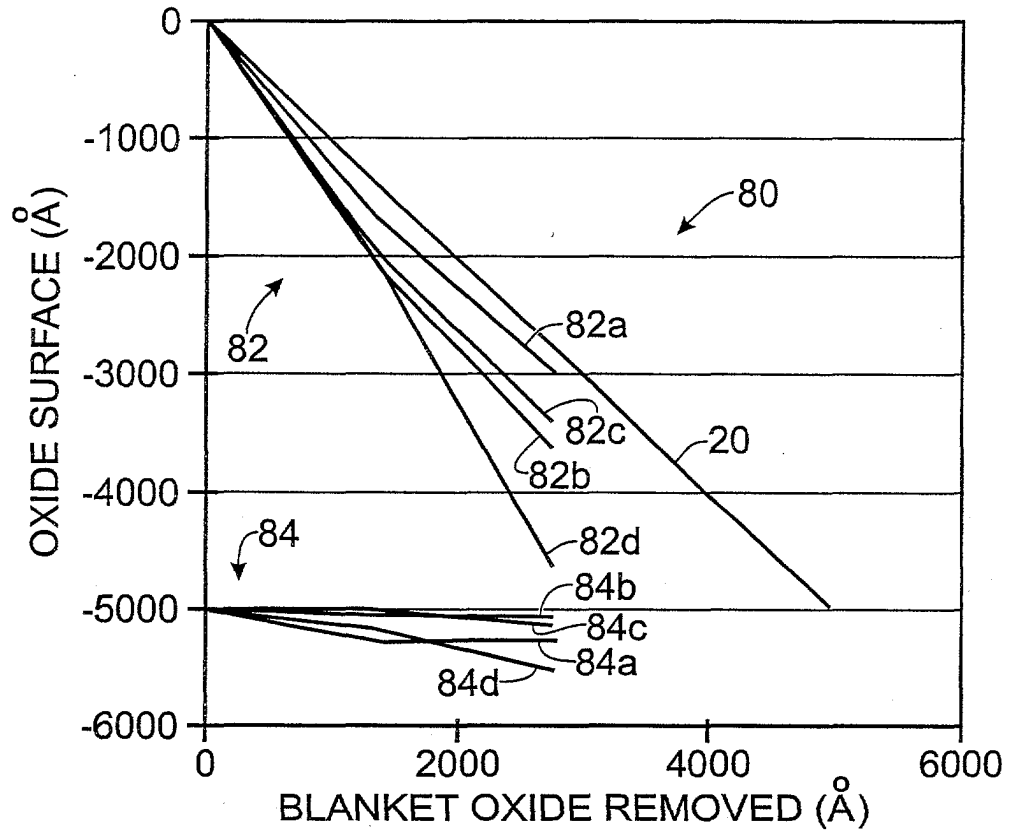


Fig. 8

